10. SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives discussed in Section 9 were evaluated against the nine evaluation criteria as specified by CERCLA. These criteria include:

1. **Overall Protection of Human Health and the Environment**—This criterion addresses whether a remedy provides adequate protection of human health and the environment, and describes how risks posed by each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

2. **Compliance with ARARs**—This criterion addresses whether a remedy will meet all of the ARARs under federal and state environmental laws and/or justifies a waiver.

3. **Long-Term Effectiveness and Permanence**—This criterion refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup goals have been met.

4. **Reduction of Toxicity, Mobility, or Volume Through Treatment**—This criterion addresses the degree to which a remedy employs recycling or treatment that reduces the toxicity, mobility, or volume of the COCs, including how treatment is used to address the principal threats posed by the site.

5. **Short-Term Effectiveness**—This criterion addresses any adverse impacts on human health and the environment that may be posed during the construction and implementation period, and the period of time needed to achieve cleanup goals.

6. **Implementability**—This criterion addresses the technical and administrative feasibility of a remedy including the availability of materials and services needed to implement a particular option.

7. **Cost**—This criterion includes estimated capital and operation costs, expressed as net present-worth costs.

8. **State Acceptance**—This criterion reflects aspects of the preferred alternative and other alternatives that the state favors or objects to and any specific comments regarding state ARARs or the proposed use of waivers.

9. **Community Acceptance**—This criterion summarizes the public's general response to the alternatives described in the Proposed Plan and in the RI/FS, based on public comments received.

A detailed comparative analysis of the alternatives for each release site group is presented in Section 6 of the OU 3-13 FS (DOE-ID 1997a) and the FS supplement (DOE-ID 1998a). A summary of this analysis for the first seven CERCLA criteria is presented by site release group in the following text and in Tables 10-1 through 10-7. A discussion of CERCLA Criteria 8 and 9 is found in Section 10.8.

10.1 Tank Farm Soils Interim Action (Group 1)

10.1.1 Overall Protection of Human Health and the Environment

Alternative 3 provides the most overall protection of human health and the environment. All three alternatives limit human and ecological receptor exposure to contaminants by maintaining the existing institutional controls, which are a common component of all of the alternatives. Alternatives 1 and 2 do not provide any direct action to limit leaching and transport of contaminants from the surface soils to the perched water. Alternative 3 includes remedies involving engineering controls to limit surface water infiltration into contaminated soils and leaching and transport of contaminants to perched water. Implementation of surface water controls to limit future soil contaminant leaching and transport to the perched water will reduce the future risk to the SRPA. All of the alternatives will provide perched water monitoring to determine if additional degradation of perched water is occurring. Table 10-1 summarizes the comparative analysis of the Tank Farm Soils interim action alternatives.

10.1.2 Compliance with ARARs

All of the proposed alternatives comply with the ARARs and to be considered (TBCs) during the interim action period, which ends in 2008. These alternatives would also comply with the ARARs beyond the interim action period as long as the existing institutional controls are maintained. ARARs concerning monitoring well installation and other construction activities will be met using engineering controls, health and safety practices, and radiological control methods.

10.1.3 Long-term Effectiveness and Permanence

None of the proposed alternatives provide long-term effectiveness or permanence. As interim measures, the period of performance is assumed to be about 8 years (until 2008) or until the final remedy is selected and implemented. The proposed alternatives will minimize human and ecological receptor exposure to contaminants during the interim action period. Alternative 3 will limit further perched water degradation during the interim action period. It is presumed that the final Tank Farm remedy developed under OU 3-14 will provide an effective and permanent long-term solution that mitigates human and environmental exposure risks and limits further perched water degradation.

10.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

None of the alternatives provide a reduction of toxicity, mobility, or volume through treatment since treatment will not be implemented during the interim action period. Some reduction in contaminant mass, and thus volume, is achieved indirectly through natural radioactive decay of short-lived radionuclides, such as Cs-137 and Sr-90; however, the contaminant toxicity will remain the same. Reduction in contaminant mobility will be achieved by implementing the surface water controls in Alternative 3 to limit leaching and transport of soil contaminants to the perched water.

10.1.5 Short-term Effectiveness

All of the alternatives can be implemented without significant additional risk to the community or workers. The primary risk to the workers from implementation of Alternatives 2 and 3 involves fugitive dust and toxic substance emissions, which will be controlled with dust suppressants and engineering controls. Alternatives 2 and 3 also pose a very minor risk to workers from direct exposure to radiation and personal injury during construction activities. Sampling of the monitoring wells, proposed in all

Table 10-1. Summary of comparative analyses for the Tank Farm Soils Interim Action, Group 1.

Criterion	Alternative 1	Alternative 2	Alternative 3
Overall Protection	N	N	Y
Compliance with ARARs	Y	Y	Y
Long-term Effectiveness	5	5	3
Reduction of Toxicity, Mobility, or Volume	N	N	N
Short-term Effectiveness	3	3	3
Implementability	1	3	3
Net Present Value Cost	$3.4M	$10.0M	$15.1M

5 = least satisfies criterion; 1= best satisfies criterion; Y = yes, criteria will be met; N = no, criteria will not be met

alternatives, poses very minor risks to personnel. Alternative 3 poses similar risks to workers while implementing the surface water controls. Personal injury and radiation exposure will be minimized through radiological engineering controls and safe work practices to maintain exposures ALARA. An alternative will be protective of the community in the short term as the Tank Farm is not located near a population base and access restrictions will remain in place during the interim action period. All three alternatives will be protective at the time of implementation.

10.1.6 Implementability

All of the proposed alternatives are technically and administratively implementable. None of the alternatives require any special materials, equipment, or personnel that are not readily available at the site. Each of the alternatives can be easily implemented using existing controls along with standard sampling, monitoring, and construction methods that are currently used at the site. Alternative 1 is the easiest to implement since it allows for continuation of the existing activities at the Tank Farm and the INTEC. Alternatives 2 and 3 involve additional monitoring well construction and implementation of surface water controls, which are also readily implemented by personnel at the site. Minor implementability concerns are posed by the underground utilities in and around the Tank Farm while implementing subsurface activities. These risks will be minimized through coordination with operating personnel familiar with the Tank Farm and the adjoining facilities.

10.1.7 Cost

Alternative 1 is the least costly of the proposed Tank Farm interim action alternatives, as it implements current ongoing institutional controls. The cost includes management and oversight, monitoring, analysis and reporting, maintenance, and inspections. Alternatives 2 and 3 both have increased capital and operating and maintenance (O&M) costs over those of Alternative 1 associated with installing monitoring wells, monitoring perched water, and implementing surface water controls. Alternative 3 is the most expensive alternative evaluated because it includes the largest quantity of capital improvements to implement the remedies (i.e., surface grading and drainage improvements). The increased cost for Alternative 3 is reflective of the fact that it provides the greatest overall protection of the three alternatives. The costs for the interim action alternatives are based on an interim action period that ends in 2008. A detailed cost estimate for each alternative is presented in Appendix A of the FS supplement (DOE-ID 1998a).

10.2 Soils Under Buildings and Structures (Group 2)

10.2.1 Overall Protection of Human Health and the Environment

All of the proposed alternatives provide overall protection of human health and the environment during the institutional control period, which ends in 2095. Beyond 2095, only Alternatives 2 and 3 provide long-term protection and satisfy the applicable RAOs. Current workers will be protected by the existing institutional controls proposed in each alternative. Alternative 2 provides long-term protection of human health and the environment by isolating the contaminants with an engineered barrier designed to last for at least 1,000 years and implementing additional institutional controls. The barrier and the additional institutional controls prevent inadvertent exposures to humans or ecological receptors by limiting contaminant accessibility through engineering controls and land use restrictions. The presence of the existing buildings or structures is assumed to provide the functional equivalent of an engineered barrier and will minimize exposures until D&D is completed. Alternative 3 provides the most overall protection of human health and the environment by removing contaminated soils exposed during D&D and disposing them in the proposed ICDF. Removal of the soils will prevent exposure of humans or ecological receptors to soil contaminants. Table 10-2 summarizes the comparative analysis of the Soils Under Buildings and Structures alternatives.

10.2.2 Compliance with ARARs

All of the alternatives meet the ARARs and TBCs during the institutional control period, which ends in 2095. Beyond 2095, only Alternatives 2 and 3 satisfy ARARs. Alternative 2 meets the ARARs using institutional controls and an engineered barrier designed for 1,000 years of protection. Alternative 3 satisfies ARARs through the use of engineering controls while removing the contaminated soils and disposing of the contaminated materials in an engineered disposal facility designed to provide long-term protection of human health and the environment.

10.2.3 Long-term Effectiveness and Permanence

Alternative 1 does not provide any long-term effectiveness or permanence, because the existing institutional controls will end in 2095, and no exposure controls will remain in place. Alternative 2 provides reliable long-term effectiveness and permanence by reducing human or ecological receptor exposure to contaminants beyond 2095. The proposed engineered barrier is designed to provide long-term isolation of these release sites for up to 1,000 years, during which time the residual risk will decrease by natural radioactive decay. Alternative 3 will provide the most long-term effectiveness by removing the contaminated soils exposed during D&D and disposing of them in the proposed ICDF that will be designed for long-term isolation of radioactive materials. The residual risk posed by soils disposed in this engineered disposal facility will naturally decrease by radioactive decay of the short-lived radionuclides.

10.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

None of the alternatives reduce the toxicity, mobility, or volume of contaminants through treatment, as treatment is not included in any of the alternatives. Contaminants are indirectly reduced over time by natural radioactive decay under each alternative. Contaminant bioavailability to human and ecological receptors is also reduced by the engineered barrier. Removal and disposal of the soil contaminants in the proposed ICDF will also indirectly reduce the contaminant mobility by long-term contaminant isolation.

Table 10-2. Summary of comparative analyses for the Soils Under Buildings and Structures, Group 2.

Criterion	Alternative 1	Alternative 2	Alternative 3
Overall Protection	N	Y	Y
Compliance with ARARs	N	Y	Y
Long-term Effectiveness	5	3	1
Reduction of Toxicity, Mobility, or Volume	N	N	N
Short-term Effectiveness	5	3	5
Implementability	1	1	5
Net Present Value Cost	$6.4M	$9.2M	$8.3M[a]

a. Cost does not include the pro-rata share for construction and operation of the ICDF.

5 = least satisfies criterion; 1 = best satisfies criterion; Y = yes, criteria will be met; N = no, criteria will not be met.

10.2.5 Short-term Effectiveness

Alternative 1 can be implemented without any additional risks to the community, or workers; however, soil contaminants will continue to be accessible to ecological receptors under this alternative. Alternatives 2 and 3 can be implemented without any additional risks to the community, workers, or the environment. Risks to workers and the environment will be increased slightly during barrier construction, or soil excavation, because of worker exposure to contaminated soils, fugitive dust emissions to the environment, and the potential for personal injury accidents. Engineering controls will be used during barrier construction, or soil excavation, to minimize contaminant exposures or releases. Safe work practices will be used to minimize personal injuries. All three alternatives will meet RAOs for the soil pathway during the institutional control period. Alternatives 2 and 3 will be protective at the time of implementation.

10.2.6 Implementability

Alternatives 1 and 2 are technically and administratively feasible and can be easily implemented. Existing institutional controls proposed in Alternative 1 are currently implemented at the site and are easily continued. The additional institutional controls and engineered barrier provided in Alternative 2 have been used at other Superfund sites with similar contaminants and pose no special legal, engineering, or construction concerns. Engineered barrier construction is similar to other types of earthwork, such as highway construction, and requires no special personnel, equipment, or materials. The only significant implementability issue concerns the timing of barrier construction. The barrier cannot be constructed until adjacent buildings or structures have undergone D&D, which may not occur for several decades in the future. Alternative 3 also is readily implemented, but only if the buildings are completely removed during D&D. The timing for implementation of Alternative 3 is also dependent on D&D activities that are projected to extend over the next several decades. In addition, Alternative 3 also depends on the construction of the proposed ICDF.

10.2.7 Cost

Alternative 1 is the least costly of the alternatives because it implements ongoing institutional controls. However, it is also the least protective and effective of the alternatives. Alternative 3 is less costly than Alternative 2, although the cost does not include costs associated with constructing and operating the proposed ICDF. Alternative 2 is the most expensive alternative because of the capital costs involved in constructing the engineered barriers. However, it is easily implemented, effective, and protective of human health and the environment, all of which are reflected in the higher cost. Alternative 3 has the least O&M costs because of the elimination of environmental monitoring costs after the soils are excavated. The O&M costs are based on an institutional control period through the year 2095. A detailed cost estimate for each alternative is presented in Appendix A of the FS supplement (DOE-ID 1998a).

10.3 Other Surface Soils (Group 3)

10.3.1 Overall Protection of Human Health and the Environment

Alternatives 3, 4A, and 4B provide the most overall protection of human health and the environment of the alternatives evaluated because the contaminants will either be permanently isolated or removed and disposed in an engineered disposal facility. Alternatives 1 and 2 temporarily reduce human health risks during the institutional control period, which ends in 2095. However, Alternatives 1 and 2 are not protective of the environment because the contaminants will continue to be accessible to ecological receptors. Alternative 3 provides less overall protection than Alternatives 4A and 4B, since the contaminants cannot be covered in place by an engineered barrier during the operating life of the INTEC. Alternatives 4A and 4B will permanently remove the contaminants from the release sites. Table 10-3 summarizes the comparative analysis of the Other Surface Soils group alternatives.

10.3.2 Compliance with ARARs

All of the alternatives will satisfy the ARARs, except for Alternatives 1 and 2, which will only meet the ARARs during the institutional control period. Alternatives 3, 4A, and 4B will satisfy the ARARs using engineering controls to minimize fugitive dust emissions, health, safety, and radiological practices to limit exposures to workers, long-term containment to isolate the contaminated soils, or soil excavation and disposal to eliminate exposures to humans or the environment.

10.3.3 Long-term Effectiveness and Permanence

Alternatives 1 and 2 do not provide reliable long-term effectiveness or permanence because the existing institutional controls will end in 2095. Land use restrictions limiting land and groundwater use in Alternative 2 will provide some measure of long-term protection if maintained beyond 2095, but these controls may not effectively control potential exposure to contaminants. For Alternatives 1 and 2, natural processes, such as precipitation infiltration, erosion, and biointrusion, may cause a contaminant release to the environment. Containment of contaminated soils using an engineered barrier (Alternative 3) will provide long-term effectiveness and permanence, since the proposed barrier will designed to provide isolation for at least 1,000 years, during which time the residual risk will decrease by radioactive decay. Alternatives 4A and 4B will provide the best long-term protection by excavating contaminated soils to a depth of 3 m (10 ft) and disposing in either an on-Site (the proposed ICDF) or off-Site engineered disposal facility designed for long-term protection and contaminant isolation.

10.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1, 2, 3, and 4A do not reduce the toxicity, mobility, or volume through treatment as no treatment technologies are included in these alternatives. Construction of an engineered barrier under Alternative 3 reduces contaminant mobility by minimizing water that moves through the contaminated soils, reducing leaching and transport of contaminants. Alternatives 4A and 4B limit contaminant mobility at the release site by excavating and disposing of contaminated soils at an engineered disposal site designed to limit contaminant releases to the environment.

Table 10-3. Summary of comparative analyses for the Other Surface Soils, Group 3.

Criterion	Alternative 1	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B
Overall Protection	N	N	Y	Y	Y
Compliance with ARARs	N	N	Y	Y	Y
Long-term Effectiveness	5	3	3	1	1
Reduction of Toxicity, Mobility, or Volume	N	N	N	Y	Y
Short-term Effectiveness	1	1	3	3	5
Implementability	1	2	3	3	5
Net Present Value Cost	$6.8M	$15.0M	$37.5M	$84.9M	$ 208.4M

5 = least satisfies criterion; 1 = best satisfies criterion; Y = yes, criteria will be met; N = no, criteria will not be met.

10.3.5 Short-term Effectiveness

Alternatives 1 and 2 can be implemented without any additional risks to the community, workers or the environment. Implementing Alternative 1 or 2 will not increase environmental risks that presently exist at the sites. Earthmoving activities associated with Alternatives 3, 4A, and 4B may generate fugitive dust emissions or cause personal injury accidents that pose minor risks to workers or the environment. These risks will be minimized using dust suppressants or other engineering controls, and health, safety, and radiological practices. Transportation of contaminated soils off-Site (Alternative 4B) also poses a minor risk to communities; however, potential exposures due to transportation accidents are considered minimal. Surface soil RAOs will be achieved with all alternatives during the institutional control period. However, only alternatives 3, 4A, and 4B will attain RAOs after the institutional control period. These three alternatives will be protective at the time of implementation.

10.3.6 Implementability

All of the proposed alternatives are technically and administratively feasible because they use proven remedial technologies that are readily available. Alternative 1 is readily implemented because the existing institutional controls are currently ongoing at the site and are easily continued. Alternative 2 is also easily implemented as land use restrictions limiting land and groundwater use are used routinely at Superfund sites. Construction of engineered barriers over the Other Surface Soils release sites, Alternative 3, poses several technical difficulties. Heavy equipment would be required for barrier construction and would be required to operate within an operational radioactive material processing and storage facility without damaging existing tanks, buildings, utilities, or other infrastructure. Continued operation of the INTEC would also be affected significantly due to the presence of these construction activities and the subsequent interference to material handling and traffic flow caused by the barriers.

Alternatives 4A and 4B involve excavation of contaminated soils and either on-Site disposal at the proposed ICDF or treatment and off-Site disposal. Both of these alternatives are implementable as they use standard excavation equipment and disposal at an engineered disposal facility which is similar to a common landfill operation. Alternative 4A will require the procurement, design, and construction of an on-Site soil disposal site southwest of the INTEC facility (see Section 9.3.1.4). Alternative 4B is the most difficult alternative to implement because it requires the removal, treatment, and transportation of large volumes of contaminated soils, great distances off-Site and depends on the availability of off-Site disposal.

10.3.7 Cost

Alternative 1 is the least expensive of the proposed alternatives, but also provides the least long-term effectiveness. Costs increase proportionally for Alternatives 2, 3, 4A, and 4B because of capital cost expenditures, as do the overall protectiveness and effectiveness of each alternative. Alternative 4A, which involves construction design, construction, and operation of an on-Site disposal facility for excavated soils and debris, is designed for INEEL-wide disposal. Alternative 4B, which involves treatment and off-Site disposal, is the most costly alternative. The O&M costs for Alternatives 2, 3, and 4A are based on an institutional control period through the year 2095. A detailed cost estimate for each alternative is presented in Appendix A of the FS supplement (DOE-ID 1998a).

10.4 Perched Water (Group 4)

10.4.1 Overall Protection of Human Health and the Environment

All of the proposed perched water alternatives will provide overall protection of human health and the environment during the institutional control period, which ends in 2095. Alternative 1 will only be protective until 2095. However, excluding Tank Farm contaminant contributions, which are being addressed by OU 3-14, Alternatives 2 and 3 will reduce contaminant flux to the SRPA, resulting in SRPA groundwater MCLs being met. Alternative 2 eliminates exposure to contaminants using land and groundwater use restrictions and minimizing contaminant transport between the surface soils and the SRPA by limiting the available water in the perched zone. The available water will be reduced by closing the existing percolation ponds. Decreased water content in the perched zone will increase the contaminant travel times, allowing for radioactive decay and natural attenuation processes to decrease contaminant concentrations and reduce the residual risk in the perched zone and the SRPA. Alternative 3 only provides minor additional protection of human health and the environment over Alternative 2 by removing contaminant mass and decreasing the water content of the perched zone at an increased rate at contaminant hotspots. Table 10-4 summarizes the comparative analysis of the Perched Water alternatives.

10.4.2 Compliance with ARARs

Alternative 1 does not satisfy the ARARs. Alternatives 2 and 3 meet all of the ARARs if the Tank Farm contaminant contributions are excluded. Plutonium from the Tank Farm soils was predicted to reach the SRPA at concentrations of concern in the future. This predicted migration of plutonium to the aquifer would only occur if current transport assumptions for plutonium isotopes hold true, and no further actions were taken at the Tank Farm (see Section 6 of the RI/BRA for additional information). Remediation of the radionuclide-contaminated soil sources will be addressed in the Tank Farm RI/FS, OU 3-14.

10.4.3 Long-Term Effectiveness and Permanence

Alternative 1 will not provide long-term protection because no active remedial measures will be implemented. The existing institutional controls temporarily reduce human health and environmental risks, but will only be in effect until 2095. After 2095, Alternative 1 provides no long-term protection. Infiltration controls implemented as part of Alternative 2 to control aquifer recharge will provide long-term effectiveness and permanence, prior to and beyond 2095, through restrictions limiting land and

Table 10-4. Summary of comparative analyses for the Perched Water, Group 4.

Criterion	Alternative 1	Alternative 2	Alternative 3
Overall Protection	N	Y*	Y*
Compliance with ARARs	N	Y*	Y*
Long-Term Effectiveness	5	1	1
Reduction of Toxicity, Mobility, or Volume	N	N	Y
Short-Term Effectiveness	1	3	5
Implementability	1	3	5
Net Present Value Cost	$7.3M	$20.0M	$259.2M

* = excluding Tank Farm contaminant contributions, reduced contaminant flux to the SRPA will satisfy the MCLs.

5 = least satisfies criterion; 1 = best satisfies criterion; Y = yes, criteria will be met; N = no, criteria will not be met.

groundwater use and by reducing the water available for contaminant transport in the perched zone. Alternative 2 will minimize the perched water contaminant transport rate between the surface soils and the SRPA. Increased transport times will allow for radioactive decay of short-lived radionuclides. Alternative 3 also provides long-term protection of human health and the environment because contaminant transport associated with seepage from the percolation ponds is eliminated. Removing contaminant mass in the perched water and decreasing the water available for contaminant transport by extraction and treatment is not considered effective. Alternative 3 does not provide more overall protection than Alternative 2 because, after recharge sources are eliminated, pumping results in very little water yield and contaminant mass removal.

10.4.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 or 2 do not reduce the toxicity, mobility, or volume of contaminants through treatment, as treatment is not included in these alternatives. Alternative 3 does reduce contaminant volume through treatment by extracting and treating contaminated perched water. Alternatives 2 and 3 indirectly minimize contaminant mobility by reducing the quantity of water available for contaminant transport in the perched zone.

10.4.5 Short-term Effectiveness

All of the alternatives can be implemented without any additional risks to the community, workers, or the environment. Alternative 1 poses no additional risk to workers. Implementation of the aquifer recharge controls and extraction and treatment may pose a slight risk increase by exposure or personal injury to workers performing the construction and treatment activities, but will be mitigated using health and safety plans, radiological controls, and safe work practices. Alternative 1 is protective of human health during the institutional control period, but is not protective of the environment as it doesn't reduce contaminants in the perched water. Alternatives 2 and 3 are protective at the time of implementation, although Alternative 3 might not provide any additional protection in the short-term due to uncertainties of the effectiveness of extraction.

10.4.6 Implementability

All of the alternatives are technically and administratively implementable. None of the alternatives require any special materials, equipment, or personnel that are not readily available at the site or from the local community. Existing institutional controls proposed in Alternative 1 are currently in place at the site and can be easily continued. Alternative 2 is also readily implemented using standard construction methods and requires no special personnel, equipment, or materials. Alternative 2 may pose some implementability challenges, as this alternative requires replacement of the existing percolation ponds, which are currently used by INTEC operations. Alternative 3 also poses additional implementability concerns because of the surface and underground utilities that occur throughout the plant that could be damaged by activities such as installation of perched water extraction wells or construction of holding tanks and transfer lines.

10.4.7 Cost

Alternative 1 is the least expensive alternative evaluated because it only involves continuation of existing institutional controls and perched water monitoring. Conversely, it provides the least overall protection effectiveness and reduction of toxicity, mobility or volume of all the alternatives. Alternative 2 has higher capital costs than Alternative 1 because of the implementation of aquifer recharge controls. The O&M costs for Alternatives 1 and 2 are similar since perched water monitoring will be conducted under each alternative. Alternative 3 is the most costly alternative because it involves construction and operation of perched water extraction wells and a water treatment facility for 25 years. A detailed cost estimate for each Perched Water alternative is presented in Appendix A of the FS supplement (DOE-ID 1998a).

10.5 Snake River Plain Aquifer Interim Action (Group 5)

10.5.1 Overall Protection of Human Health and the Environment

Each of the proposed alternatives temporarily eliminates human health and environmental risks using existing institutional controls. Alternative 1 will not provide human health protection beyond the institutional control period, which ends in 2095. Alternatives 2A, 2B and 3, provide long-term protection through implementation of additional institutional controls such as land use restrictions until groundwater cleanup goals are achieved. These controls would limit land and groundwater use as long as they remain in place. According to conservative groundwater modeling, predictions Alternative 2A may not satisfy MCLs by 2095 (see Figure 10-1). Groundwater monitoring is required to verify that RAOs are achieved. Alternatives 2B and 3 contain contingent active remediation of the SRPA to meet MCLs by 2095, if the COC action level(s) are exceeded. Table 10-5 summarizes the comparative analysis of the SRPA alternatives.

10.5.2 Compliance with ARARs

Alternatives 1 and 2A do not comply with ARARs beyond the institutional control period. Alternatives 2B and 3 are predicted to achieve ARARs before 2095.

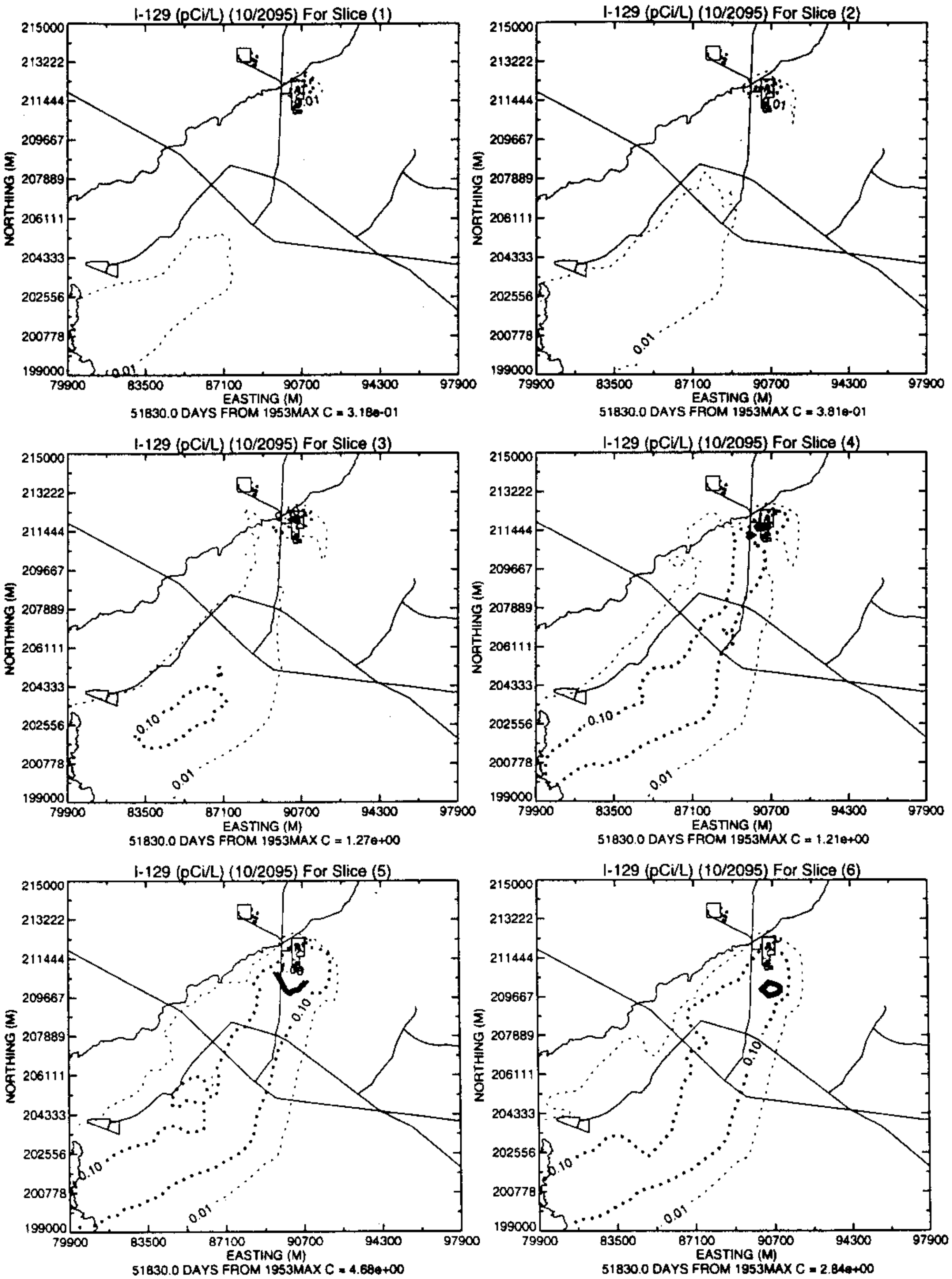

Figure 10-1. Predicted I-129 concentrations for slices 1-10 in 2095.

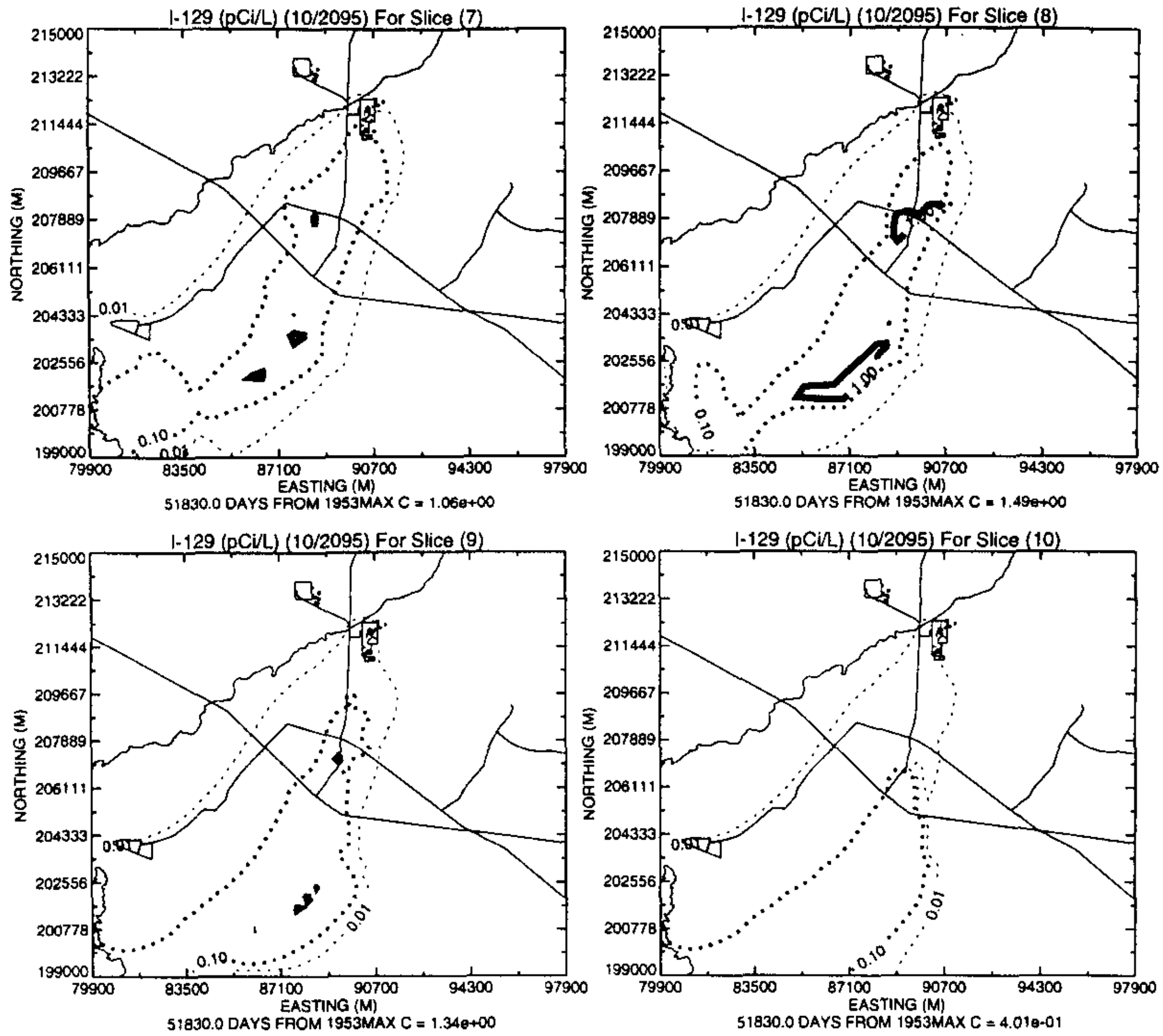

Figure 10-1. (continued).

Table 10-5. Summary of comparative analyses for the Snake River Plain Aquifer Interim Action, Group 5.

Criterion	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3
Overall Protection	N	Y	Y	Y
Compliance with ARARs	N	Y	Y	Y
Long-term Effectiveness	5	3	3	3
Reduction of Toxicity, Mobility, or Volume	N	N	Y	Y
Short-term Effectiveness	1	1	3	3
Implementability	1	1	5	4
Net Present Value Cost	$13.9M	$14.8M	$39.8M	$787.9M

5 = least satisfies criterion; 1 = best satisfies criterion; Y = yes, criteria will be met; N = no, criteria will not be met.

10.5.3 Long-term Effectiveness and Permanence

Alternative 1 does not provide any measure of long-term protection because no remedial actions will be performed, other than existing institutional controls, which end in 2095. Restrictions limiting land and groundwater use proposed in Alternative 2A will provide long-term protection beyond 2095 as long as the restrictions remain in place. Alternative 2A will provide long-term effectiveness by removal of recharge sources under Group 4. Active remediation in Alternatives 2B and 3 will provide long-term effectiveness by removal of COCs from the groundwater. The risk reduction achieved using Alternative 3 does not provide additional long-term benefit compared to Alternative 2A or 2B. Since Alternative 2B achieves the same level of risk reduction at a lower cost, it is considered superior to Alternative 3.

10.5.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternatives 1 and 2A do not reduce toxicity, mobility, or volume through treatment, as treatment is not included in these alternatives. Alternative 2B reduces both volume and toxicity of contaminants in the SRPA. Alternatives 2B and 3 will reduce contaminant mobility using hydraulic controls and contaminant volume using extraction and treatment.

10.5.5 Short-term Effectiveness

All of the alternatives can be implemented without any additional risks to the community or the environment. Alternatives 2B and 3 pose a minor short-term risk from personal injury to workers during extraction and injection well installation and construction of the treatment facilities. The potential for injury risks will be minimized using health and safety plans and safe work practices. All alternatives provide short-term effectiveness. Alternatives 2B and 3 will be protective by 2095.

10.5.6 Implementability

Alternatives 1 and 2A are technically and administratively implementable. The existing institutional controls are currently implemented at the site and are easily continued. Most of the additional institutional controls proposed under Alternative 2A and 2B have been used at numerous Superfund sites and pose no special implementability concerns. Groundwater extraction, treatment, and injection technologies proposed under Alternatives 2B and 3 pose implementability concerns regarding handling of excessive volumes of extracted water and available groundwater treatment technologies for I-129 and other COCs removal. Groundwater extraction at depths of 183 m (600 ft) can be implemented without any special personnel, equipment, or materials. Alternatives 2B and 3 will also require handling and treatment of millions to billions of gallons of contaminated groundwater. Bench-scale treatability testing may be required to determine the most appropriate treatment and extraction technology for the low concentration contaminants present in the SRPA groundwater. In addition, extraction of contaminated groundwater from the low permeability H-I layer is more technically challenging than aquifer extraction contemplated in Alternative 3.

10.5.7 Cost

Alternative 1 is the least costly of the alternatives evaluated but provides the least overall protection and long-term effectiveness. Alternative 2A is more costly because of additional monitoring costs. Alternatives 2B and 3 cost the most because they include extraction and treatment costs. Alternative 3 extraction and treatment capacity is much larger than 2A, yielding higher costs. Overall protection, long-term effectiveness, and reduction in toxicity, and mobility and volume increase with increased costs. A detailed cost estimate for each alternative is presented in Appendix A of the FS supplement (DOE-ID 1998a).

10.6 Buried Gas Cylinders (Group 6)

10.6.1 Overall Protection of Human Health and the Environment

Alternatives 2 and 3 provide overall protection of human health and the environment. Alternative 1 does not provide overall protection because no effective access controls are in force at these sites. Alternatives 2 and 3 fully satisfy the RAOs for the buried gas cylinder sites. Alternative 3 achieves the RAOs through containment and will be protective for at least 1,000 years. Alternative 3 may be protective beyond 1,000 years, but it was only evaluated for the minimum design life of the barrier. Alternative 2 provides the most overall protection at the buried gas cylinder sites because the hazardous reactive and ignitable gasses will be removed, treated, and disposed in an engineered disposal facility. Table 10-6 summarizes the comparative analysis of the Buried Gas Cylinders alternatives.

10.6.2 Compliance with ARARs

Alternative 1 does not comply with ARARs during the institutional control period. Alternative 2 satisfies all of the ARARs using engineering controls and proper disposal procedures. Alternative 3 complies with all of the ARARs during the barrier's 1,000-year functional design life. Beyond 1,000 years, it is assumed that the waste and the large soil mass comprising the barrier will continue to minimize risks.

10.6.3 Long-term Effectiveness and Permanence

Alternative 1 does not provide any measure of long-term effectiveness or permanence. Alternative 2 will provide the highest degree of long-term effectiveness and permanence. The buried gas cylinders will be removed and treated. The remaining cylinder casings and treatment residue will be disposed in an approved treatment, storage, and disposal facility. Alternative 3 provides a high degree of long-term effectiveness and permanence by containing the waste. The use of the containment barrier would reduce the current risk to human and ecological receptors for the design life of the barrier.

Table 10-6. Summary of comparative analyses for the Buried Gas Cylinders, Group 6.

Criterion	Alternative 1	Alternative 2	Alternative 3
Overall Protection	N	Y	Y
Compliance with ARARs	N	Y	Y
Long-term Effectiveness	5	1	3
Reduction of Toxicity, Mobility, or Volume	N	Y	N
Short-term Effectiveness	1	5	3
Implementability	1	3	3
Net Present Value Cost	$6.4M	$1.8M	$8.2M

5 = least satisfies criterion; 1 = best satisfies criterion; Y = yes, criteria will be met; N = no, criteria will not be met.

10.6.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1 does not reduce the toxicity, mobility, or volume of waste through treatment since treatment is not included in this alternative. Alternative 2 includes treatment to reduce the toxicity, mobility, and volume of the hazardous components in the buried gas cylinders. Alternative 3 does not reduce contaminant toxicity or volume through treatment. Contaminant mobility is reduced through installation of an engineered barrier over the buried gas cylinders, which will minimize contaminant mobility in the event of a release by isolating the cylinders beneath a large mass of earth materials.

10.6.5 Short-term Effectiveness

All of the alternatives can be implemented without any significant additional risk to the community or the environment. The primary risk to the community and the environment from these alternatives involves fugitive dust or toxic air emissions, which will be controlled with dust suppressants and engineering controls. Additional risk may occur to workers while implementing alternatives during characterization, removal, and treatment of the buried gas cylinders. Hazardous gas exposure and occupational injuries will be minimized through the use of personnel trained in industrial hygiene, safe work practices, and health and safety. Alternative 1 provides the greatest degree of short-term effectiveness because remediation will not be conducted to change the current site conditions. Alternative 2 has the least short-term effectiveness because of the possibility for explosion or chemical exposure of workers implementing these alternatives. Alternative 3 poses a minor risk to workers from exposure to hazardous gases and explosive cylinders during placement of the stabilization pad and construction of the engineered barrier. Alternative 1 will not be protective as RAOs will not be achieved. Alternatives 2 and 3 will be protective at the time of implementation.

10.6.6 Implementability

Each of the alternatives retained for detailed analysis is technically and administratively implementable. The necessary personnel, services, and materials are readily available. Alternative 1 only requires a continuation of the existing institutional controls already implemented at the site. Alternative 2 requires specialized construction equipment and materials. Buried compressed gas cylinder retrieval and treatment is an available commercial technology that can be used on the identified contaminants and is readily implemented by a specialty contractor. Alternative 3 is technically and administratively implementable. Alternative 3 requires no specialized construction personnel, equipment, or materials.

Existing institutional controls are currently implemented at the site and are easily continued. Construction of an engineered barrier is similar to other types of earthwork, such as highway construction, and can be readily implemented.

10.6.7 Cost

Alternative 2 is the least costly of the alternatives evaluated, and provides the most overall, long-term protection. Alternatives 1 and 3 are similar in cost and are much more costly than Alternative 2 because these alternatives include 100 years of environmental monitoring, whereas, Alternative 2 does not include environmental monitoring after the buried gas cylinders are removed. Alternative 3 is the most expensive alternative because it includes increased capital costs for constructing an engineered barrier. A detailed cost estimate for each alternative is presented in Appendix A of the FS supplement (DOE-ID 1998a)

10.7 SFE-20 Hot Waste Tank System (Group 7)

10.7.1 Overall Protection of Human Health and the Environment

Alternative 1 is not protective of human health and the environment because no active remedial measures will be implemented to limit the threat of contaminant release to the environment. Alternatives 2, 3, and 4 are the only alternatives that fully satisfy the SFE-20 tank system RAOs. Alternative 2 achieves the RAOs through in situ treatment and containment and will be protective for at least 1,000 years. Alternative 2 probably may be protective beyond 1,000 years, but it was only evaluated for the minimum design life of the barrier. Alternatives 3 and 4 provide the greater protection of the SFE-20 tank system alternatives because the radioactive liquids and/or sludges will be removed, treated, and disposed in an engineered disposal facility. Alternative 4 provides the most overall protection of human health and the environment. Table 10-7 summarizes the comparative analysis of the SFE-20 tank system alternatives.

10.7.2 Compliance with ARARs

Alternative 1 does not comply with the ARARs either during the 100-year institutional control period or beyond. Alternative 2 complies with all of the ARARs and TBCs during the barrier's 1,000-year functional design life. Beyond 1,000 years, it is assumed that the solidified waste and the large soil mass comprising the barrier will continue to minimize exposure risks from alpha-emitting radionuclides and satisfy all of the ARARs and TBCs. Alternatives 3 and 4 will satisfy all of the ARARs.

10.7.3 Long-term Effectiveness and Permanence

Alternative 1 does not provide any measure of long-term effectiveness or permanence beyond the institutional control period, which ends in 2095. Alternative 2 provides a high degree of long-term effectiveness and permanence by solidifying and containing the waste. Alternative 3 will provide a high degree of long-term effectiveness and permanence because the tank liquid will be removed, treated and disposed, the tank sludge solidified using grout, and the tank and associated structures filled with grout to prevent future exposures. Alternative 4 will provide the highest degree of long-term effectiveness and permanence because the tank liquid and sludge will be removed, treated, and disposed, and the remaining components of the tank system will be excavated and disposed at the proposed ICDF.

Table 10-7. Summary of comparative analyses for the SFE-20 Tank System, Group 7.

Criterion	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Overall Protection	N	Y	Y	Y
Compliance with ARARs	N	Y	Y	Y
Long-term Effectiveness	5	3	3	1
Reduction of Toxicity, Mobility, or Volume	N	Y	Y	Y
Short-term Effectiveness	1	3	5	5
Implementability	1	3	5	5
NPV Cost	$6.4M	$8.7M	$8.5M	$4.6M

5 = least satisfies criterion; 1 = best satisfies criterion; Y = yes, criteria will be met; N = no, criteria will not be met.

10.7.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Alternative 1 does not reduce the toxicity, mobility, or volume of waste through treatment since treatment is not included in this alternative. Alternatives 2, 3, and 4 include treatment to reduce the mobility or volume of the radioactive liquid and sludge. The toxicity of the radionuclides is not directly reduced by any of these alternatives.

10.7.5 Short-term Effectiveness

All of the alternatives can be implemented without any significant additional risk to the community or the environment. The primary risk to the community and the environment from these alternatives involves fugitive dust or toxic air emissions, which will be controlled with dust suppressants and engineering controls. Additional risk may occur to workers while implementing the alternative because of radiation exposure during characterization, removal, and treatment of the tank liquids and sludges.

External radiation exposure and occupational injuries will be minimized through the use of personnel trained in radiological controls, safe work practices, and health and safety plans to maintain exposures ALARA. Alternative 1 provides the greatest degree of short-term effectiveness because remediation is not required and will prevent worker-exposure. Alternative 2 poses a minor risk to workers from direct exposure to radiation during grouting of the tank system and construction of the barrier. Alternative 3 and 4 have the least short-term effectiveness because of the higher possibility for external radiation exposure of workers implementing these alternatives. Alternative 1 will be protective during the institutional control period only. Alternatives 2, 3, and 4 will be protective at the time they are implemented.

10.7.6 Implementability

Each of the alternatives retained for detailed analysis is technically and administratively implementable and the necessary personnel, services, and materials are locally available. Alternative 1 is readily implemented, as it requires no change in the existing operations and conditions at the site. Alternative 2 requires no specialized construction equipment or materials. Grouting is a common technology that is routinely used to isolate wastes and is readily implemented. An engineered barrier is also a demonstrated remediation technology that uses standard earth moving methods for construction.

Barriers are routinely used to control exposures and leaching and transport of contaminants. Barriers have been used at numerous Superfund sites. Alternatives 3 and 4 are more difficult to implement than Alternatives 1 and 2 because of the potential for construction workers to be exposed to radiation or occupational injury during the characterization, removal, handling, treatment, or disposal of the tank liquids, sludges, and other components. Engineering controls, health and safety plans, radiation controls, and safe work practices will be used to minimize radiation exposure and reduce personal injury. Treatment of similar tank liquids at the PEW evaporator is routinely conducted and would be reliable for these alternatives. Solidification of the tank system is readily implemented, as grouting is a demonstrated technology that has been used at numerous Superfund sites.

10.7.7 Cost

Alternative 4 is the least costly of the alternatives evaluated for the SFE-20 tank system, and it provides the most long-term effectiveness of the alternatives. Alternatives 1, 2, and 3 are similar in total costs but vary slightly in capital costs. Alternative 4 is much less expensive than the other alternatives because Alternative 4 does not include long-term environmental monitoring for the 100-year institutional control period. Alternatives 2 and 3 cost essentially the same because of higher capital costs. Alternative 2 is the most expensive alternative because it includes capital costs for grouting the tank system and constructing an engineered barrier. A detailed cost estimate for each alternative is presented in Appendix A of the FS supplement (DOE-ID 1998a).

10.8 Modifying Criteria

The modifying criteria, state and community acceptance, are used in the final evaluation of remedial alternatives. For both of these criteria, the factors include the elements of the alternatives that are supported, the factors of the alternatives that are not supported, and the elements of the alternatives that have strong opposition.

10.8.1 State Acceptance

The IDHW has been involved in the development and review of the OU 3-13 RI/FS report, the Proposed Plan (DOE-ID 1998b), and this ROD. All comments received from IDHW on these documents have been resolved and incorporated into these documents accordingly. In addition, IDHW has participated in public meetings where public comments and concerns have been received and responses offered.

The IDHW concurs with the selected remedial alternatives for the sites contained in this ROD and is signatory to the ROD with DOE and EPA.

10.8.2 Community Acceptance

Community participation in the remedy selection process and Proposed Plan reviews includes participation in the public meetings held November 16 through 19, 1998. Community acceptance is summarized in the Responsiveness Summary presented as Appendix A of this document. The Responsiveness Summary includes comments received either verbally or in writing from the public, and the Agencies' responses to these comments. A total of about 55 people not associated with the project attended the Proposed Plan public meetings. The community was generally supportive of the proposed remedial actions. All comments received on the Proposed Plan were considered during the development of this ROD.